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Critical Levels of Debt?

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High credit growth in Central and Eastern European countries (CEEC) over recent years has sparked interest among many market analysts. Although banking supervision has improved, the continuation of such growth may cause concern about the threat of financial crisis. This paper is written with the aim of analysing the importance of debt factors as a potential cause of financial crises. First, a comparison is conducted of various debt indicators from episodes of crisis in banking across European countries since the 1970s. Second, a probit analysis is used to measure the probability of a crisis. Based on this analysis, it can be claimed that any direct link between debt indicators and financial crises is weak. However, there is some evidence that once the crisis occurs, greater indebtedness lengthens the crisis and raises costs in terms of GDP.

JEL code: C23, E44, F34, G20

Keywords: financial crisis, indebtedness indicators

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Introduction

The motivation for this research has come from the recent high growth of private sector borrowing in several Central and Eastern European Countries (CEEC). On the credit demand side, this increase is fed by good economic prospects and amplified by integration into the European Union (EU). On the supply side, the country risks are smaller than ever: this leads to high (short-term) inflow of foreign funds. High credit growth increases the fragility of the banking sector and worsens the situation in the case of a sudden reversal of capital flows. Although supervision of the banking sector has improved, the question of the future stability of the financial sector in the current situation, where the yearly increase in loans is higher than 30 percent, is continuously under the attention of many analysts. Local national authorities are in a complicated position in having to offset potential liquidity (and safety net) problems in case macroeconomic imbalances (partly fed by generous funding itself) reach a critical level.

The aim of this paper is to assess the effect of increasing private sector (households and enterprises) debt on the health of the financial sector and draw particular conclusions for Estonia. To that end, the debt developments in present EU and acceding countries are compared and links with financial crises discussed.

This paper takes the macroeconomic approach to the analysis of indebtedness. As a proxy for debt, the domestic credit data from IFS is used. The definition of a financial (banking) crisis is, as in Caprio and Klingebiel (2003), when banks fail or when there is public intervention in order to save banks. The paper uses data from 1970 to 2002, with the exception of CEEC where the period starts from 1990 or later. The paper does not deal with microeconomic supply risks, such as a bank's exposure to risk from credit in relation to the bank's capital buffers or the size of loan losses that could be fatal in a banking crisis, nor the demand side of loans.

The paper is structured as follows. The first section gives an overview of the theoretical literature on indebtedness and financial crisis. The second section presents data and compares the debt level and growth rates in crisis episodes with the overall developments in Europe. In the third section, probit models are estimated to find whether debt variables have any explanatory power over crises. The fourth section contains an assessment of the relationship between debt levels and the severity of a crisis, and more important conclusions for Estonia.

1. Literature Overview

The relationship between private sector debt and financial sector health is not straightforward. On the one hand, a rapid increase in indebtedness may increase the vulnerability of the financial sector or even trigger a crisis when excessive credit risks are realized. On the other hand, countries can have a high level of debt if the financial sector is developed, thereby suggesting the low probability of a crisis.

The amount of literature on indebtedness is vast, but the majority of papers deal with issues related to the government debt. In the 1980s, after the opening of capital accounts, a wave of literature on private credit arose, e.g. McKinnon (1982) and Dornbusch (1983 and 1984). The main concern of these papers was the large inflow of international money through such an undeveloped local banking system (McKinnon and Pill 1996 and Haque *et al.* 1997).

Another wave of literature came after the 1997 Asian crisis. Gavin and Hausmann (1998) proposed several reasons for credit booms being associated with financial vulnerability. First, after liberalization, banks can introduce and expand into new business areas where they have little expertise. Accompanied by the likely increase in competition, this may lead to an underestimation of the credit risks. Secondly, independent from the development of the banking sector, one bank can distort the market in such a way that all banks must enter risky projects. For example, one bank raises interest on deposits to attract new customers. The moral hazard here becomes obvious, as the clients need not consider the risks for their deposits when the authorities provide deposit insurance. Thirdly, the adverse problem of selection – during periods of economic boom, banks might have difficulty sorting the good projects from the bad ones. During high credit growth, banks tend to have higher monitoring, screening and accounting costs; hence excessive risks may be taken. At the point of an economic downturn, the adverse effects of these risks are realized at once[1]. Finally, as many authors have stressed, such private debt increases are of concern when there is doubt that the loans taken are invested in risky assets or a lending boom is characterised by an asset-price bubble. Concerning the latter issue, the financial accelerator approach (e.g. Bernanke *et al*. 1996) provides essential support for explaining the pro-cyclical effects of lending behaviour.

Regardless of the mispricing of risks resulting from credit booms, there are several reasons why increasing or high levels of debt should be looked at when dealing with financial crises. Most importantly, in the case of high levels of debt, the economy is very sensitive to interest rate changes. Since the investment decisions of rational borrowers are based on expectations about future interest rate levels (and income flows), any considerable deviations from the expected levels could threaten the borrowers' ability to perform their obligations. Thus, a significant increase in the ratio of interest payments to GDP may substantially deteriorate private sector balance sheets and therefore the quality

[1] The channel for financial instability might work through the increase of debt accumulation relative to assets (Davis 2003). An initial positive shock leads to increased debt to make use of a profitable investment. After the adverse developments appear, either followed by a cyclical downturn or policy tightening, a crisis can be triggered as agents may lack sufficient liquid assets to meet their liabilities.

of the banks' loans, especially in economic downturns. Moreover, the high share of non-performing loans in the banks' loan portfolios may trigger a capital reversal that could worsen the situation further. Hence not only is the probability of a crisis affected, but also the severity of it.

Debt indicators are more often included in empirical financial crisis analysis. Honig (2003) introduced two indicators, domestic credit to GDP and the growth of domestic credit with a lead of one year in a probit analysis. Although both variables indicated a positive link between a higher level of credit or credit growth and crisis, the correlation was statistically insignificant.

In an earlier paper Demirgüç-Kunt and Detragiache (1997) included credit growth with a two-year lag in the crisis model and also found a positive link between the two. The correlation was statistically significant at the 5% confidence level for one out of three of the estimated equations. The later work of Demirgüç-Kunt and Detragiache (2000) use a multivariate logit analysis to check for type I and type II errors. The conclusions from their previous work, where high credit growth in the past increases the probability of a crisis, still held.

Prompted by the main findings from the Asian crisis, the most recent studies focus on liquidity crises. Hardy and Pazarbasioglu (1999) test whether the gross foreign liabilities of the banking sector (with lags of up to two years) can be used as a leading indicator of crisis. Based on mixed evidence they claim that the variable is statistically significant in explaining financial crises even if the often-severe banking sector difficulties do not need to reach the level of crisis.

By investigating the case of Thailand 1980–96, Jansen (2002) found that the financial and monetary system in Thailand experienced a significant inflow of foreign private capital. As a result, the current account deficit did not deteriorate as exports caught up with imports with a two-year lag. Hence the country was not insolvent, but after facing a capital reversal, it became illiquid. This was the cause of the crisis in 1997.

The same kind of argument is used by Rodric and Velasco (1999). Their econometric tests show that the level of short term funding among banks and other institutions over the country's reserves, increases the probability of a capital-flow crisis. The debt/GDP ratio also raises the danger of capital reversals. However, the crisis risk is smaller if the ratio of medium and long-term debt to reserves is higher. An increase in the level of indebtedness during the preceding 3 years does not influence the probability of a sharp reversal in capital flows.

Corbo and Hernandez (1996) and Gourinchas *et al.* (2001) count several adverse effects of credit booms. The authors find that credit booms are associated with appreciation of the exchange rate and accumulation of foreign exchange reserves, which in turn feed the current account deficit. General macroeconomic factors can deteriorate to the extent of resulting in crisis. The situation becomes especially dangerous when fiscal or monetary policy is loosening. Many of the above-mentioned conditions, where a credit boom can cause a banking crisis, are not present in Estonia. For example McKinnon and Pill (1996)

stress the importance of foreign exchange exposure and settlement of payments related risks. The issues of credit risk (granting loans to risky projects), the role of undue expectations (loans causing bubbles on stock or real estate markets) or liquidity issues (unsustainable funding) should be examined case by case.

The link between lending booms and the vulnerability of the banking sector in the empirical literature is statistically weak. In a survey article, Mariano *et al.* (2000) show that credit to the private sector has been found significant in at least one of the tests in 5 out of 7 papers. For Asian countries, the debt was higher than GDP in 3 out of 5 cases during the 1997 crisis, and credit to private sector real growth of debt higher than 20% in two out of five cases.

The statistical significance of the debt indicator depends on the number of variables included in the regression and on the choice of countries examined. In the papers where only the countries in crisis are analysed, the debt indicator seems to precede the crisis, whereas if more countries are included, the effect of indebtedness or growth rate, as a signal, fades. And, as noted by Davis (1995), the theories on debt mostly consider the steady state and not how debt markets behave when states change, or in the transition between them.

2. Crises and Debt Indicators in Europe

2.1. Crises and Debt Developments

Europe has faced several crisis situations in the financial sector since the 1970s. The list of financial crises presented by Caprio and Klingebiel (2003) are used below. The sample includes all countries in the enlarged European Union from May 2004 and 3 candidate countries – Bulgaria, Romania and Turkey. There are 28 countries altogether – referred to as EU25+3. Twenty-two instances of crisis have occurred in these countries, out of which, 10 occurred in CEECs in the 1990s and two in Turkey. From the 1970s onwards, there have been 10 instances of crisis in developed EU countries (see Table 2.1). The table does not include any crisis where the International Monetary Fund (IMF) International Financial Statistics (IFS) database fails to provide sufficient statistics. Hence, those from the early 1990s in CEECs (Czech Republic in 1991, Poland starting from 1990, Romania starting from 1990 and Slovakia also starting from 1991) and the crisis in Denmark in the late 1970s are excluded. A distinction between severe crises and borderline cases is possible, but according to the objectives of this paper, all episodes are included.

Table 2.1. Share of private credit to GDP and to reserves in crisis episodes in EU25+3 since 1970

Country	Years of crisis	Debt to GDP				Debt to Reserves			
		Level	Change before the crisis			Level	Change before the crisis		
			P points 1 year	P points 3 years	Percent 3 years		P points 1 year	P points 3 years	Percent 3 years
EE	**1992–1995**	**7.49**	**-11.32**						
LV	1995–?	7.9	-8.53			1.17	-0.26	1.17	57.79
TR	1994	14.77	-2.23	-0.91	94.21				
LT	1995–1996	14.8	-2.83			0.66	-0.44		
BG	1995–1997	21.06	17.3	15.29	365	2.14	1.79	1.58	382.56
SI	1992–1994	23.27	-11.65			3.98	-37.29		
EE	**1998**	**25.28**	**-1.19**	**10.47**	**170.72**	1.69	0.11	0.80	189.54
GR	1991–1995	34.66	-2.1	-3.23	91.47	6.02	-2.90	-0.47	92.77
UK	1974–1976	37.07	1.41	15.08	168.6	10.74	0.71	6.95	283.60
HU	1991–1995	39.17	-7.42	-7.63	83.69	3.47	-11.43	-5.21	39.94
SE	1991	52.47	-3.62	0.25	100.49	7.29	-0.37	-3.55	67.25
IT	1990–1995	56.51	2.75	5.35	110.45	9.85	0.17	-2.87	77.47
DK	1987–1992	73.07	3.29	-0.03	99.96	5.87	-4.10	-1.64	78.14
ES	1977–1985	84.14	-3.21	2.75	103.38	16.12	-1.95	4.73	141.55
FR	1994–1995	88.04	-4.89	-8.61	91.09	39.77	-4.10	4.87	113.95
FI	1991–1994	94.29	7.56	14.79	118.61	15.80	3.04	2.70	120.65
TR	1982–1985					2.67	-1.99	-1.95	57.79
Average		42.12	-1.67	3.63	133.14	8.48	-3.93	0.55	131.00

Source: authors' calculations based on IFS and Caprio and Klingebiel (2003)

Another ratio extensively used in crisis literature is private credit to reserves, which shows whether the credit is backed by the reserves of the central bank. In Estonia, where the market operations of the central bank are limited because of the currency board arrangement (CBA), the asset structure of the central bank does not affect liquidity (or supply of credit) in the market. Also, due to the CBA, Eesti Pank cannot provide a lender of last resort facility; the market participants themselves should create their own liquidity buffers. Thus for Estonia, the issue of the reserves of the central bank in that respect is irrelevant, although in the case of many other CEE countries we should consider the magnitude of the reserves for the time-period up to EMU membership. The amount of reserves is a major issue when the fixed exchange rate is attacked. Successful defence of currency requires trust in the system.

Private credit[2] (also referred to as debt) includes bank lending to the private sector. Unfortunately, it does not include loans from non-banking financial companies, such as leasing enterprises. The IFS database does not provide information about those loans with sufficient time series given to other financial enterprises to add to the data. The debt

[2] The alternative total domestic credit in the economy includes financial enterprises, but also local government's gross and central government's net debt (see Appendix 1 Figure 3). Subtraction of the last two components is again impossible due to data limitations (as will be shown below). The gross external liabilities (with and without FDI) indicator expresses the total liabilities of a country. This indicator includes all debt that domestic agents possess, but again includes the debt of government, which can differ significantly from country to country. The IFS database does not offer series for gross domestic liabilities. The closest proxy is gross liabilities minus FDI, but as part of FDI comes in the form of loans, the two numbers do not coincide. The data series are relatively shorter compared to other debt indicators.

indicator most often used is the ratio of debt to GDP. A country's level of debt shows its ability to earn money to pay for the interest rate and finally also for the debt.

There are two approaches available for assessing growth rates – change measured as the change in percentage standings or as the percentage of the change itself. If we use the former, an increase from two to four percent could be seen as being equal to an increase from 90 to 92 percent. But such changes should not be treated equally because in the former case the debt level doubles, but in the latter case, the change is almost unnoticeable. Instead the percentage of the change itself is used. The growth rate of indebtedness here would respectively be for the two previous examples 100% and 2.2%. In Table 2.1 above, if the percentage changes are higher than 100, then the level of indebtedness has increased and if less than 100, then the debt level has decreased. A high percentage increase in the level of indebtedness is only possible when the initial debt level has been low. For example in Bulgaria, the debt level increased by more than four times (the debt level is 560% of the level one year before the crisis), but reached the moderate level of 25% of GDP because of the low initial level of debt[3].

The level of indebtedness shows significant variance starting from below 10% in Estonia and Latvia up to the level in Finland where indebtedness at the beginning of the crisis was already more than 90%. Variance is also high for growth rates. On one hand, in more than half of the cases, the share of credit to GDP was lower three years before the crisis, so the level of indebtedness increased. On the other hand, there are many countries where the level of debt actually decreased before the crisis. For the majority of cases, the one-year change is negative. This might be due to the effect of the crisis itself. First, this might be due to the timing of an adverse economic shock, or simply that the effect of contracting credit is present in the loan statistics for the same year (if the crisis started at the beginning of the year).

The simple mean level of private sector credit to GDP in European countries since 1945 is 44% (see Table 2.2). The respective ratio in Estonia is 20%. However, credit has grown in Estonia, resulting in a debt level of 29.17% at the end of the period. When adding the domestic leasing liabilities, debt reaches 46.5%. And the total debt for the private sector in Estonia accounted for about 63% of the overall total in 2002 because of direct borrowing from abroad.

[3] The enormous lending growth in Bulgaria up to 1996 was caused by unsound lending practices – banks were obliged to extend loans to state-owned enterprises. Also, as a result of supervision in the country being in its infancy, a great number of loans were extended to businesses with a relationship to bank management (many private banks were established by entrepreneurs who wanted to finance their other business activities). In 1997, after the banking crises peaked, stricter lending policies were applied.

Table 2.2. Private credit to GDP and to reserves and their growth rates in the U25+3 from 1970 to 2002*

Country	Level				Annual Average Percentage Changes			
	Debt to GDP		Debt to Reserves		Debt to GDP		Debt to Reserves	
	Mean	End	Mean	End	Average	St. Dev	Average	St. Dev
AT	0.80	1.06	9.18	10.37	2.59	3.58	4.76	15.93
BE	0.43	0.76	5.49	10.94	5.53	18.86	8.79	21.45
BG	0.12	0.18	1.23	0.67	48.29	142.95	57.51	172.92
CY	0.68	1.25	3.09	4.37	3.97	7.72	6.42	20.20
CZ	0.62	0.32	3.23	1.03	-8.24	10.27	-15.58	23.28
DE	0.94	1.19	16.20	32.98	1.73	2.96	5.24	11.84
DK	0.43	0.35	8.99	2.72	-0.88	7.93	-1.01	34.07
EE	0.20	0.29	1.35	1.99	8.88	28.64	19.49	23.15
ES	0.81	1.11	10.78	9.45	2.21	6.01	2.22	25.17
FI	0.59	0.60	14.52	7.15	1.27	6.23	7.15	45.85
FR	0.74	0.87	23.56	32.86	1.63	3.46	5.01	21.91
GR	0.41	0.67	8.21	4.33	4.36	15.58	2.35	28.64
HU	0.38	0.35	4.39	2.36	-1.08	10.07	1.41	34.20
IE	0.51	1.10	3.48	8.50	5.13	14.70	9.86	29.38
IT	0.63	0.82	15.06	21.45	0.71	5.94	5.76	32.82
LT	0.13	0.14	1.05	0.87	1.67	17.59	0.18	21.26
LU	1.12	1.11	170.31	215.09	0.71	9.75	16.32	13.44
LV	0.16	0.29	1.13	2.04	10.57	29.93	14.56	30.32
MT	0.68	1.20	1.11	2.21	3.05	9.30	4.86	17.41
NL	0.75	1.48	8.60	15.19	4.70	4.43	6.81	17.21
PL	0.16	0.29	3.38	1.98	59.20	266.18	14.52	92.61
PT	0.85	1.48	7.16	6.77	2.87	10.24	6.64	28.31
RO	0.09	0.08	0.99	0.54	-2.40	25.79	-3.80	67.50
SE	0.43	0.44	9.34	6.83	0.38	7.21	0.02	27.59
SI	0.30	0.39	5.58	1.29	1.98	13.08	-15.63	32.94
SK	0.47	0.40	4.05	1.14	-2.33	18.71	-16.49	37.22
TR	0.18	0.14	5.77	0.99	-1.17	14.47	-11.18	22.59
UK	0.75	1.43	23.19	59.04	7.12	15.93	12.97	35.80
Average	0.51	0.71	13.23	16.61	5.80	25.98	5.33	35.18

Source: authors' calculations based on IFS

*** End of Period for the debt to GDP ratio is 2002 with the exception of Denmark 1999 and Sweden 2000. End of period for the debt to reserves is 2002 with the exceptions of the euro countries 1997, Denmark 1999 and Sweden 2000.**

The correlation between the debt to GDP and debt to reserves is low. At the mean, the correlation coefficient is 0.63 and for the end periods 0.30. The levels do not need to be correlated as the ratio is calculated for different monetary regimes. Growth of private credit relative to reserves is higher in Estonia than in developed European countries. High

standard deviations indicate that the growth of private credit to GDP and to reserves is not stable over time, but there are periods of high growth and low growth.

For most of the countries, the average growth of private credit to GDP has been between zero and five percent per year. Those countries with high credit growth had low initial debt levels (Estonia, Latvia) and the reverse is true, for example, for the Czech Republic. The average growth rates in the EU15 are low mainly because of relatively high levels of debt throughout the period, as otherwise the growth could be explosive. The high standard deviations indicate that the growth of private credit to GDP and reserves is not stable. This shows that the debt dynamics during the crises do not stand out as extreme events in the data. There are many countries with a high level of indebtedness that did not experience crisis.

2.2. Linkages Between the Level of Debt, Debt Growth and Crises

The simplest method for measuring the correlation between debt indicators and crises is to compare two datasets: one representing crisis episodes and the other, all European countries. This approach suffers from one drawback – the analysis does not take into account other factors that influence the probability of crisis.

First, the levels of debt to GDP and to reserves are analysed. The number of countries facing banking crises is relatively high at low levels of credit to GDP (see Table 2.3). This relationship is not present at low levels of debt to reserves ratios (see Table 2.4). At the same time, there are many countries facing high private debt to GDP and to reserves ratios without experiencing any financial crisis. The share of highly indebted European countries is about the same as the share of countries experiencing crises. Hence, debt level can only be significant in explaining crises when some other factors are present, but cannot be a crisis indicator alone.

Table 2.3 Comparison of the debt to GDP ratio in crisis episodes with all ratios in the EU25+3 since 1970

Debt/GDP		Crisis episodes			All countries, all periods		
From	To	Episodes	Share	Cum Share	Episodes	Share	Cum Share
0	9	2	13.33	13.33	23	3.34	3.34
10	19	2	13.33	26.67	41	5.95	9.29
20	29	3	20.00	46.67	82	11.90	21.19
30	39	2	13.33	60.00	69	10.01	31.20
40	49	0	0.00	60.00	92	13.35	44.56
50	59	2	13.33	73.33	89	12.92	57.47
60	69	0	0.00	73.33	37	5.37	62.84
70	79	1	6.67	80.00	74	10.74	73.58
80	89	2	13.33	93.33	59	8.56	82.15
90	99	1	6.67	100.00	41	5.95	88.10
Higher than 100		0	0	100.00	39	82	11.90
Total		15			689	100	

Source: authors' calculations based on Caprio and Klingebiel (2003) and IFS

Table 2.4. Comparison of the debt to reserves ratio in crisis episodes with all ratios in the EU25+3 since 1970

Debt/Reserves		Crisis episodes			All countries, all periods		
From	To	Episodes	Share	Cum Share	Episodes	Share	Cum Share
0	1.9	3	20.00	20.00	121	18.88	18.88
2	3.9	4	26.67	46.67	116	18.10	36.97
4	5.9	1	6.67	53.33	67	10.45	47.43
6	7.9	2	13.33	66.67	54	8.42	55.85
8	9.9	1	6.67	73.33	72	11.23	67.08
10	19	3	20.00	93.33	152	23.71	90.80
20 and more		1	6.67	100.00	68	59	9.20
Total		15	100		641	100	

Source: authors' calculations based on Caprio and Klingebiel (2003) and IFS

There are several other macro-level ratios that could be of interest when analysing crisis probability. For a small open economy, the ratio of private debt to exports indicates the ability to ensure the continuity of income flows. The gross external liabilities show the overall indebtedness of the economy, taken as FDI subtracted from gross external assets. The same conclusions can be drawn on these ratios in the crisis episodes and all periods (see Appendix, Tables 1 and 2). There are more crises at the lower levels of the ratio. This refers again to the low level of financial intermediation and several CEE countries having crises at the beginning of transition with low levels of debt. The same type of analysis does not give additional input when other indicators such as external liabilities to exports are compared (not shown in the paper). High levels of ratios do not seem to be important indicators for crises.

Although the level of debt in EU15 countries is on average higher than in the full sample, the conclusions made above are also robust for the sub-sample of EU15 members (not shown in the paper). The low level of private credit to GDP refers to the underdevelopment of the banking sector rather than the low probability of a crisis. Also, several countries faced a banking crisis after liberalisation of the sector. The crisis was caused by low institutional quality and other factors that were specific to the economic conditions.

Second, the increase in the level of indebtedness has been analysed. The results of the comparison of indebtedness growth rates to GDP and to reserves are presented in Tables 2.5 and 2.6.

Table 2.5. Comparison of 3 years of private credit growth to GDP before crisis episodes with the EU25+3 growth rates since 1970

Percentage change in Debt/GDP		Growth before crises episodes			EU25+3 growth rates since 1970		
From	To	Episodes	Share	Cum Share	Episodes	Share	Cum Share
less	-20	0	0.00	0.00	54	8.94	8.94
-19	-10	1	9.09	9.09	44	7.28	16.23
-9	0	3	27.27	36.36	103	17.05	33.28
1	10	2	18.18	54.55	159	26.32	59.60
11	20	2	18.18	72.73	101	16.72	76.32
21	30	0	0.00	72.73	63	10.43	86.75
31	40	0	0.00	72.73	27	4.47	91.23
41	50	0	0.00	72.73	10	1.66	92.88
51	100	2	18.18	90.91	32	5.30	98.18
101	more	1	9.09	100.00	11	1.82	100.00
		11	100.00		604		

Source: authors' calculations based on Caprio and Klingebiel (2003) and IFS

The crises are concentrated around the debt to GDP growth rates from slightly negative (-10) to medium positive growth rates (+20% during the three years before the crisis) and growth rates higher than 50%. There were no crises experienced at the medium values between 21% and 50%. The highest credit growth rate 3 years before crisis was in Bulgaria, where the level of debt measured as a percentage in GDP tripled. The other high growth cases with crisis episodes were in the UK (1974–76) and Estonia (1998). There might be other CEEC where the increase might have been high, but the data is not available for the early 1990s.

Table 2.6. Comparison of 3 years of private credit growth to reserves in crisis episodes with the EU25+3 growth rates since 1970

Percentage change in Debt/GDP		Growth before Crisis episodes			EU25+3 growth rates since 1970		
From	To	Episodes	Share	Cum Share	Episodes	Share	Cum Share
less	-30	4	30.77	30.77	114	20.54	20.54
-29	-20	2	15.38	46.15	40	7.21	27.75
-19	-10	0	0.00	46.15	31	5.59	33.33
-9	0	1	7.69	53.85	47	8.47	41.80
1	10	0	0.00	53.85	58	10.45	52.25
11	20	1	7.69	61.54	41	7.39	59.64
21	30	1	7.69	69.23	52	9.37	69.01
31	40	0	0.00	69.23	29	5.23	74.23
41	50	1	7.69	76.92	24	4.32	78.56
51	100	1	7.69	84.62	81	14.59	93.15
101	more	2	15.38	100.00	38	6.85	100.00
Total		13	100		555	100	

Source: authors' calculations based on Caprio and Klingebiel (2003) and IFS

The debt to reserves gives a somewhat different picture. Crisis seems more probable when the debt to reserves ratio has increased more than 100 percent compared to the level three years before. This indicates that the debt level has increased significantly. On the other end, a sudden decrease in the ratio also seems to have some relation to the probability of financial crises.

3. Probit Model for Banking Crises in Europe

3.1. Theory and Data

For estimating the potential factors that influence the probability of a banking crisis we use the following random effects *probit* model.

$$CRSA_{it} = \beta_1 X_{it-1} + \beta_2 D_{it-1} + \alpha_i + \varepsilon_{it}, \qquad (3.1)$$

where

$CRSA_{it}$ - binary variable that represents the state of a crisis (0 for non-crisis, 1 for crisis);

X_{it-1} - the macroeconomic control variables;

D_{it-1} - the debt related variables;

α_i - country specific intercept;

ε_{it} - error term.

The data for crisis episodes comes from the most often used Caprio and Klingebiel (2003) dataset. To isolate the macroeconomic disturbances caused by the crisis from the ones that caused the crisis we exclude the observations of crisis years. Only the first year of a crisis is included. To decrease the problems with simultaneous effects between exogenous and endogenous variables we used exogenous variables with a one-year time lag.

From among macroeconomic variables, the real GDP and foreign direct investment data were selected as proxies for real sector activity. As these two variables are correlated with each other in most countries, only one of them was included in the model. GDP as a proxy of overall economic activity was selected, as this variable is more consistent between countries and proved to be more significant in the estimations. The real interest rate (measured as a difference between average loan interest rate and CPI inflation) was included in the model. We expect interest rates to increase before the crisis. This hypothesis is supported by the estimation. As a proxy for exchange rates we used the price of the USD in the local currency. The rationale behind including the USD exchange rate in the model is related to loan repayment ability. If there is a negative correlation between the probability of a crisis and the USD exchange rate, then price competitiveness has an influence on the health of the banking sector. The ratio of reserves to GDP was included to see if changes in reserves might have some impact on crises.

In addition to the above-mentioned macroeconomic variables, various debt-related variables were included in our model. The selection of the variables depended heavily on the data available. From debt related variables, several indicators were tested. First we used the ratio of total credit to gross domestic product. The aforementioned variable was not found to have a statistically significant effect on the probability of a crisis. Then we tested government liabilities, but the data series for government liabilities are relatively short and inconsistent. The last variable that ruled out other debt variables was private debt. We expected a positive correlation between private debt and the probability of a crisis. Two alternative specifications were tested – one with private credit *per capita* and other with the ratio of private credit to GDP.

There are many other factors triggering crisis and affecting severity of it: maturity risk, currency risk, sector risk (incl. asset-price bubbles). Several institutional features (quality of financial supervision, legal framework, competition etc.) of particular country may amplify or decrease the effects of macroeconomic variables on financial stability.

3.2. Estimation Results

We estimated equation (3.1) using the population averaged probit method. The results are reported for two specifications. The difference between the specifications is the indebtedness indicator. First we used the *per capita* private credit as a proxy for indebtedness. In the second specification indebtedness is defined as the ratio of private credit to GDP. As shown in Table 3.1, the results indicate a negative relationship between economic activity and banking crises. If economic growth decreases then there is a higher probability of a banking crisis. The significance of the USD varies between specifications. Therefore the possibility of a link between the competitiveness of local enterprises in export markets and financial stability is relatively weak. When the local currency depreciates against the USD then local companies become more competitive in exports markets and the gains from exports may have a positive influence on their ability

Table 3.1. Results of estimation (in elasticities)

	Specification 1				**Specification 2**			
	Coef.	**Std. Err.**	**z**	**P>|z|**	**Coef.**	**Std. Err.**	**z**	**P>|z|**
GDP volume (-1)	-0.00048	0.00022	-2.20	0.027	-0.00064	0.00028	-2.32	0.021
Reserves to GDP (-1)	-0.036	0.017	-2.11	0.035	-0.037	0.021	-1.77	0.077
USD exchange rate (-1)	-0.000065	0.00004	-1.55	0.12	-2.46e-06	0.00	-0.64	0.52
Real interest rate (-1)	0.0029	0.001	2.47	0.014	0.0029	0.0013	2.26	0.024
Credit per capita (-1)	6.06e-09	0.00	1.64	0.10				
Private credit to GDP (-1)					0.011	0.0079	1.36	0.17
No of obs.	390				390			

to repay loans, but the results are not statistically significant. The effect of the USD exchange rate on financial stability depends on the exchange rate regime: if the local currency is pegged to a non-USD currency and/or most of the foreign trade consists of non-USD transactions, then the influence of the USD exchange rate on financial stability is less significant.

The impact of reserves and real interest rates was found to be significant in both specifications. An increase in reserves, measured by the reserves to GDP ratio, decreases the probability of a banking crisis. Increases in real interest rates imply a higher probability of a banking crisis. The results were similar with nominal interest rates (not listed here), but less significant than with real interest rates. The positive relationship between interest rates and the probability of banking crises may be considered relatively robust and straightforward: higher interest rates increase the loan servicing costs and therefore also the probability of loan repayment problems, which at the economy-wide level may lead to financial instability.

Only the coefficient of the debt indicator was not robust, *i.e*. the significance of the coefficient varied between different specifications. When we use private credit *per capita* as a proxy for indebtedness, the coefficient may be considered different from zero (although at a relatively low level of significance). The same specification using the ratio of private credit to GDP does not indicate a statistically significant non-zero value for the debt indicator. This implies that the level of indebtedness may not have as clear an impact on the probability of a crisis as macroeconomic variables. On the other hand, the ratio itself may be, to some extent, misleading. The higher ratio of debt to GDP may show that before the crisis periods the growth of private credit decreases faster than GDP (for example the early signs of credit rationing). As there is a time lag between the credit growth and its impact on economic growth, the growth rate of the ratio of private credit to GDP may even decrease before the crisis.

The results of the estimation imply that the connection between financial stability and macroeconomic variables is somewhat clearer than the link between indebtedness and financial stability. It could be argued that the growth of private credit increases the probability of a crisis, but the coefficient depends relatively much on model specification and is therefore unrobust. We can conclude that the influence of indebtedness on financial stability has more important indirect effects (via the influence on other macro- and microeconomic variables) and therefore may not show clear direct implications for financial stability.

4. Other Effects of Debt and Estonia-Specific Questions

4.1. Levels of Indebtedness and the Severity of the Crisis

Even, if there is limited evidence that the probability of a crisis is related to the development of private indebtedness, there might be a correlation between the level of indebtedness and the severity of the crisis. It is conditional probability that expresses the length or loss of GDP growth when the crisis has occurred, independently of whether it was caused by the indebtedness or not. By grouping the crisis episodes according to their duration (see Table 5.1), it can be observed that for the crises that last longer than 6 years,

the debt level is significantly higher than that for the shorter crises[4]. The correlation coefficient between the duration and the level of indebtedness is relatively high (0.45).

Table 4.1. Length of crisis and average debt level

Length of crisis	Number of Crises	Average Debt Level (% of GDP)	St. dev
1–2 years	5	39.07	31.42
3–5 years	7	36.72	27.70
6 years and longer	3	71.24	13.91

Source: authors' calculations based on Caprio and Klingebiel (2003) and IFS

There is no agreed method for measuring the cost of a crisis in terms of GDP. Here the country's average growth rate is applied 7 years before and after the crisis. The added differences between the average growth rates and growth during the crisis was used as a proxy for economic cost (see Table 4.2). The correlation coefficient between the debt level and the cost in terms of GDP (measured using a negative sign) was low, but nevertheless positive (0.11). The sign, showing that the higher the level of indebtedness, the lower the severity of the crisis, was the reverse of what was expected. Once Spain, as an outlier (high economic growth during a long crisis), is excluded, the correlation becomes negative (-0.20). The higher the initial level of debt, the higher the cost in GDP growth. The same relationship holds for the sub-sample of developed countries.

Table 4.2. Debt level and crisis cost in terms of GDP

		Level of debt at crisis	Average GDP growth	Average loss of GDP growth during crisis years*	GDP growth over average growth					
Country	Time				Crisis year	1y later	2y later	3y later	4y later	5y later
LV	1995–?	0.08	5.79	-9.28	-5.79	-2.11	2.60	-1.03	-2.95	1.06
TR	1994	0.15	3.28	-8.74	-8.74	3.91	3.73	4.24	-0.19	-8.00
LT	1995–1996	0.15	4.92	-5.17	-4.92	-0.24	2.08	2.39	-6.75	-0.94
BG	1995–1997	0.21	-4.82	0.38	7.73	-5.28	-2.07	4.82	4.82	4.82
SI	1992–1994	0.23	2.14	-3.73	-7.60	0.70	3.18	1.97	1.69	2.30
EE	1998	0.25	5.21	-0.61	-0.61	-5.84	2.09	1.25	0.77	-5.21
GR	1991–1995	0.35	2.31	-5.20	1.15	-1.88	-3.22	-0.86	-0.40	0.05
UK	1974–1976	0.37	2.07	-5.40	-3.41	-2.62	0.63	0.38	1.23	0.63
HU	1991–1995	0.39	1.27	-17.45	-13.17	-4.33	-1.85	1.68	0.22	0.05
SE	1991	0.52	2.20	-3.30	-3.30	-3.95	4.55	1.96	1.86	-0.91
IT	1990–1995	0.57	2.13	-5.18	-0.15	-0.74	-1.36	-3.01	0.08	0.80
ES	1977–1985	0.84	4.24	9.14	-0.04	3.99	2.08	1.56	1.54	0.83
FR	1994–1995	0.88	2.21	-0.74	-0.42	-0.33	-1.14	-0.32	1.27	0.89
FI	1991–1994	0.94	2.47	-16.63	-8.72	-5.79	-3.61	1.48	1.34	1.54

Source: authors' calculations based on Caprio and Klingebiel (2003) and IFS
** If the crisis is longer than 5 years, only the first 5 years are taken into account.*

There is some evidence that a higher level of indebtedness is associated with higher crisis cost in terms of GDP. However, this cost cannot be fully accounted for by the financial crisis. This is especially true in the case of Finland, which suffered from the crisis in

[4] The only crises used in the analysis were those with a duration that was known precisely, in total 15 cases (crises that continued throughout the 1990s (Romania and Slovakia) were again excluded from the sample as crisis shows the development stage of the sector.

Russia at the beginning of 1990s. Although the financial crisis can be accounted for by domestic factors, the effects are difficult to measure. The same holds for the financial crises in some of the CEEC (Estonia, Poland, Romania) in the early 1990s, where the crisis was caused by the underdevelopment of the banking sector instead of being related to the level of debt.

4.2. The Estonian Context

The structure of the banking sector is quite different in the different European countries. If we compare the IFS data series with data on sector debt (i.e. aggregated debt liabilities of households and non-financial enterprises) derived from financial accounts statistics, this variation becomes evident (see Table 5.3). In some countries, like Sweden, Lithuania and Filand, bank loans account for less than 50% of total private debt. In Estonia the respective figure is 37%, showing that 63% of Estonian debt comes from domestic leasing companies and from borrowing abroad. Unfortunately, the data for all financial liabilities is not available for long time periods for a large number of countries. Therefore, it is not possible to use this data in empirical analysis. With the exception of Sweden, domestic bank loans as a percentage of total indebtedness, is about 60% for most of the countries in Europe. Variation in the level of overall indebtedness, however, remains high.

Table 4.3. Bank lending and total level of debt in European countries, end-2002

Country	IFS (Debt to GDP)	Financial Accounts Statistics (Debt to GDP)	Difference (IFS statistics, %)
AT	1.03	1.31	79
BE	0.77	1.16	66
CZ	0.32	0.54	60
DE	1.19	1.40	85
EE	**0.29**	**0.63**	**46**
ES	0.87	1.30	67
FI	0.52	1.03	50
FR	0.83	1.26	66
HU	0.35	0.55	64
IT	0.59	0.85	69
LT	0.14	0.30	46
NL	1.07	2.11	51
PT	1.03	1.65	63
SE	0.44	1.61	27
UK	1.43	1.73	83

Sources: IFS and Financial Account Statistics (Eurostat)

This high variation in indebtedness could be partly explained by the fact that the financial structures in different European countries vary. On the one hand, direct access to international capital has an impact; on the other hand, in many CEE countries FDI plays a significant role in financing domestic activities. The linkage between the types of financing and financial stability requires further research.

As the banking sector becomes more stable – gains a greater understanding of how to handle risk and is prudently supervised by the respective authorities – then the question remains open, what does the level of indebtedness or the rapid growth in indebtedness cause, if anything. In fact, countries that start from a low level of capital need a lot of investment during the development stage. In general, these countries do not have developed capital markets; hence money entrainment in the form of loans is a solution. If increase in domestic credit is associated with faster 'catch-up' growth, then the positive effects of increase in indebtedness may also be relevant for Estonia.

Finally, when dealing with debt issues it should not be forgotten that the banking sector in Estonia, as well as elsewhere in Europe, is stronger than ever. There are more advanced tools for managing risk and supervision has become stronger. However, the role of banks, in transforming short-term deposits into long-term loans, is the same. Hence, even if the banks are perfectly solvent, the question of liquidity remains open. This is especially true for Estonian banks, which rely heavily on foreign funding. Once international investors (among them parent banks) change the composition of their assets and decide to limit or even cut their exposure in Estonia, this might have negative consequences for the net earnings of banks and/or these banks may suddenly become illiquid. If the situation lasts longer, this may, in a worst-case scenario, trigger a bank panic and result in a solvency crisis.

Conclusions

Several approaches were used in this paper to measure the effect of the level and growth of indebtedness in the non-government sector in European countries. The results showed that debt factors perform poorly for indicating problems in the financial sector. The direct statistical link between the level and growth of indebtedness and financial crisis is weak. Many countries that have had high credit growth rates have not experienced a subsequent crisis. There is some evidence that if the level of debt in a country is relatively high, the crisis may last longer and have more severe effects in terms of GDP.

The discussion of Estonia shows that future research should concentrate more on the other outcomes of credit growth, such as possible increases in domestic interest rates or a worsening of the current account. As the financial sector, on the whole, is in better shape than ever, the adverse effects of credit may appear elsewhere in the economy. In the end, a general worsening of the macroeconomic conditions might also cause problems for the banking sector. Another question that remains concerns the liquidity of the banks. Although being fundamentally solvent, changes in the asset portfolio of international investors may cause a sudden drop in earnings accompanied by a potential liquidity shortage, which in a worst-case scenario could lead to solvency problems.

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Appendix

Table 1. Comparison of the private credit to exports ratio in crisis episodes and all ratios in European countries

Percentage change in Debt/Exp		Growth before crises episodes			EU25+3 growth rates since 1970		
From	To	# of countries	% of countr	cum	# of countries	% of countr	cum
0	49	6	37.50	37.50	89	14.02	14.02
50	99	1	6.25	43.75	125	19.69	33.70
100	149	2	12.50	56.25	135	21.26	54.96
150	199	2	12.50	68.75	79	12.44	67.40
200	249	1	6.25	75.00	59	9.29	76.69
250	299	1	6.25	81.25	27	4.25	80.94
300	349	0	0.00	81.25	43	6.77	87.72
350	399	0	0.00	81.25	19	2.99	90.71
400	449	2	12.50	93.75	29	4.57	95.28
450	499		0.00	93.75	18	2.83	98.11
more		1	6.25	100.00	12	1.89	100.00
		16			635		

Source: authors' calculations based on Caprio and Klingebiel (2003) and IFS

Table 2. Comparison of gross external liabilities to GDP in crisis episodes and all ratios in European countries

Percentage change in Liab/GDP		Growth before crises episodes			EU25+3 growth rates since 1970		
From	To	# of countries	% of countr	cum	# of countries	% of countr	cum
0	19	0	0.00	0.00	4	1.30	1.30
20	29	1	14.29	14.29	32	10.42	11.73
30	39	2	28.57	42.86	59	19.22	30.94
40	49	1	14.29	57.14	35	11.40	42.35
50	59	0	0.00	57.14	33	10.75	53.09
60	69	2	28.57	85.71	31	10.10	63.19
70	79	1	14.29	100.00	14	4.56	67.75
more		0	0.00	100.00	99	32.25	100.00
		7			307		

Source: authors' calculations based on Caprio and Klingebiel (2003) and IFS